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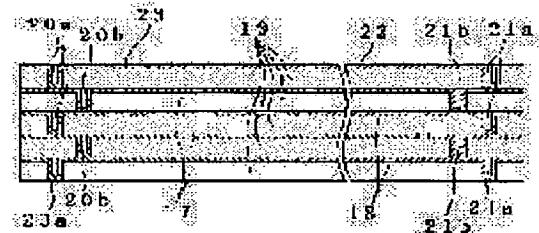
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(72)Inventor : KITAHARA TSUTOMU

(54) PIEZOELECTRIC OSCILLATION UNIT, MANUFACTURE THEREOF, AND INK JET RECORDING HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To simplify the process for forming a conductive layer for external connection while enhancing reliability.
SOLUTION: Since inner individual electrodes 17 constituting a piezoelectric oscillator or conductor layers constituting an inner common electrode 18 are interconnected through through holes 21a, 21b, 20a, 20b on the inside of the end face of the piezoelectric oscillator and connected with a segment electrode 22 and a common electrode 23 formed on the surface in the longitudinal direction, end face of intricate shape or formation of conductive layer at the corner is not required and conductive relationship is ensured even if the forward end face is chipped slightly.



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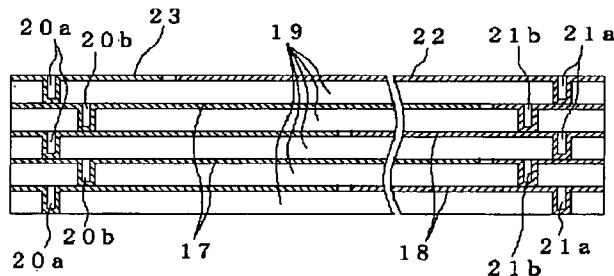
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(54)【発明の名称】圧電振動子ユニット、圧電振動子ユニットの製造方法、及びインクジェット式記録ヘッド

(57)【要約】

【課題】 外部接続用導電層の形成工程を簡素化と信頼性の向上を図ること。

【解決手段】 圧電振動子を構成する内部個別電極17、または内部共通電極18を構成する導電層同士を圧電振動子の端面よりも内側のスルーホール21a、21b、20a、20bで相互接続して長手方向の表面に形成されたセグメント電極22、コモン電極23に接続するから、形成が困難な端面や、また角部への導電層が不要となり、また先端面での若干の欠けによっても導電関係が確保される。



【特許請求の範囲】

【請求項1】 振動領域に内部個別電極と内部共通電極とがラップするように導電層を圧電材料を介して積層するとともに、少なくとも一方の端部領域で前記圧電材料を貫通し、かつ前記内部個別電極となる前記導電層同士、または前記内部共通電極となる前記導電層同士をスルーホールに充填された導電材料により接続して、前記各導電層を接続する前記スルーホールの導電材料、または前記内部個別電極同士を接続する前記スルーホールの導電材料に接続する外部電極層を長手方向の1つの面に形成した圧電振動子を複数固定基板に固定してなる圧電振動子ユニット。

【請求項2】 前記圧電振動子が、前記内部個別電極となる前記導電層同士を接続するスルーホールを圧電振動子毎に形成している請求項1に記載の圧電振動子ユニット。

【請求項3】 前記導電層が、端部に形成された前記スルーホールを埋める導電材料により導通関係を形成している請求項1に記載の圧電振動子ユニット。

【請求項4】 前記各層のスルーホールが同一線上に形成されている請求項1に記載の圧電振動子ユニット。

【請求項5】 前記各層のスルーホールが、1層おきに同一線上に位置するように形成されている請求項1に記載の圧電振動子ユニット。

【請求項6】 前記各導電層の端面が、前記圧電振動子の端面よりも中央側に位置する請求項1に記載の圧電振動子ユニット。

【請求項7】 前記スルーホールが、その1つの方向の幅が、各層の圧電材料の層厚よりも大きく形成されている請求項1に記載の圧電振動子ユニット。

【請求項8】 非振動領域が相互に接続するようにスリットにより歯割して形成されている請求項1に記載の圧電振動子ユニット。

【請求項9】 前記外部電極層が内部電極を形成する材料と同等の材料からなる請求項1に記載の圧電振動子ユニット。

【請求項10】 前記複数の振動子の長手方向の1つの面を固定基板に固定してなる請求項1に記載の圧電振動子ユニット。

【請求項11】 前記圧電振動子が圧電材料の積層方向の垂直な方向に伸縮する縦振動子である請求項1に記載の圧電振動子ユニット。

【請求項12】 前記外部電極としてセグメント電極とコモン電極とが形成されている請求項1に記載の圧電振動子ユニット。

【請求項13】 前記スルーホールが形成されていない他端の端部領域には前記長手方向の1つの面に形成された外部電極と接続する外部電極が形成されている請求項1に記載の圧電振動子ユニット。

【請求項14】 少なくとも振動領域となる側の端部近

傍に、スルーホールが穿設された圧電材料のグリーンシートに、前記スルーホールよりも中央部寄りで、かつ内部共通電極の先端に一致する領域に帯状の非導電領域を形成し、かつ前記スルーホールを埋めるように導電材料層を形成する工程と、

必要な層数だけ積層して前記セグメント電極と導通するスルーホールを埋めるように導電材料の層を形成し、焼成により1枚の圧電材料板を構成する工程と、

少なくとも導電層を相互に分離できる領域までスリットを形成する工程とからなる圧電振動子ユニットの製造方法。

【請求項15】 少なくとも振動領域となる側の端部近傍に、スルーホールが穿設された圧電材料のグリーンシートに、前記スルーホールよりも中央部寄りで、かつ内部共通電極の先端に一致する領域に帯状の非導電領域を形成し、かつ前記スルーホールを埋めるように導電材料層を形成する工程と、

少なくとも振動領域となる側の端部近傍に、スルーホールが穿設された圧電材電極の先端に一致する領域に帯状の非導電領域を形成し、かつ前記スルーホールを埋めるように導電材料層を形成する工程と、

必要な層数だけ積層して前記セグメント電極と導通するスルーホールを埋めるように導電材料の層を形成し、焼成により1枚の圧電材料板を構成する工程と、

少なくとも導電層を相互に分離できる領域までスリットを形成する工程とからなる圧電振動子ユニットの製造方法。

【請求項16】 前記スルーホールが前記圧電振動子の配列ピッチに一致するように穿設された請求項14、または請求項15に記載の圧電振動子ユニットの製造方

法。

【請求項17】 自由端となる先端側のスルーホールの配列ピッチに一致するピッチで、かつ少なくとも導電層を相互に分離できる領域までスリットを形成する工程とからなる請求項14、または請求項15に記載の圧電振動子ユニットの製造方法。

【請求項18】 振動領域に内部個別電極と内部共通電極とがラップするように導電層を圧電材料を介して積層するとともに、少なくとも一方の端部領域で前記圧電材料を貫通し、かつ前記内部個別電極となる前記導電層同士、または内部共通電極となる前記導電層同士をスルーホールに充填された導電材料により接続するとともに、前記各導電層を接続するスルーホールの導電材料、または前記内部個別電極同士を接続するスルーホールの導電材料に接続する外部電極層を長手方向の1つの面に形成した圧電振動子を複数固定基板に固定してなる圧電振動子ユニットと、

ノズル開口とリザーバとに連通して前記圧電振動子により加圧される圧力発生室を備えた流路ユニットと、
をヘッドホルダにより固定してなるインクジェット式記

録ヘッド。

【発明の詳細な説明】

【0001】

【発明が属する技術分野】本発明は、伸縮軸方向に平行に内部電極が積層形成された圧電振動子ユニット、より詳細には内部電極の構造、及びインクジェット式記録ヘッドに関する。

【0002】

【従来の技術】縦振動モードの圧電振動子を使用したインクジェット式記録ヘッドは、特開平4-1052号公報に見られるように、複数のノズルを穿設したノズルプレートの背面に狭い間隙をおいて弾性板を配設し、さらに弾性板の背面に流路形成基板の各圧力発生室に対応するよう分割した圧電定数d31の圧電振動子を当接させて構成し、リザーバからのインクをインク供給口を経由させて圧力発生室に導いた上で、ここのインクを記録信号に応じて駆動させた圧電振動子により加圧してインク滴としてノズル開口から吐出させるようにしたものである。

【0003】このような圧電振動子は、例えば特開平7-195688号公報に見られるように内部共通電極と、内部個別電極とを圧電材料を介してサンドイッチ状に積層し、内部共通電極を固定端側の後端面に、また内部個別電極を自由端側の先端面に露出させた1枚の圧電振動板を、両端にダミーの圧電振動子を、また中央部に駆動用圧電振動子を、非振動領域が連続するよう歯割して構成されている。内部個別電極は、先端面から非振動領域に延びるセグメント電極に、内部共通電極は後端面から非振動領域に延びるコモン電極に接続され、これらセグメント電極とコモン電極にフレキシブルケーブルを接続して駆動信号が供給されている。

【0004】

【発明が解決しようとする課題】このように端面と表面との2面に鉤型に外部電極を形成する関係上、端面と表面との境界での導電層に不良が生じやすく、導電層形成に手間が掛かるという問題や、また角部が比較的欠けやすく、接続不良を生じて製造の歩留まりが低下するという問題がある。本発明はこのような問題に鑑みてなされたものであって、その目的とするところは、先端の若干の欠けによっても導通関係を確保することができる圧電振動子ユニットを提供することである。また、本発明の第2の目的は、前記圧電振動子ユニットの製造方法を提案することである。さらに、本発明の第3の目的は、前記圧電振動子ユニットを使用したインクジェット式記録ヘッドを提供することである。

【0005】

【課題を解決するための手段】このような問題を解消するために本発明においては、振動領域に内部個別電極と内部共通電極とがラップするように導電層を圧電材料を介して積層するとともに、少なくとも一方の端部領域で前記圧電材料を貫通し、かつ前記内部個別電極となる前

記導電層同士、または前記内部共通電極となる前記導電層同士をスルーホールに充填された導電材料により接続して、前記各導電層を接続する前記スルーホールの導電材料、または前記内部個別電極同士を接続する前記スルーホールの導電材料に接続する外部電極層を長手方向の1つの面に形成した圧電振動子を複数固定基板に固定するようにした。

【0006】

【作用】圧電振動子を構成する内部個別電極、または内部共通電極を構成する導電層同士を圧電振動子の端面よりも内側のスルーホールに相互接続して長手方向の表面に引き出すから、形成が困難な端面や、また角部への導電層が不要となる。

【0007】

【発明の実施の形態】そこで以下に本発明の詳細を図示した実施例に基づいて説明する。図1は、本発明のインクジェット式記録ヘッドの一実施例を示すものであつて、流路ユニット1は、ノズル開口2を一定ピッチで穿設したノズルプレート3と、ノズル開口2に連通する圧力発生室4、これにインク供給口5を介してインクを供給するリザーバ6を備えた流路形成基板7と、圧電振動ユニット8の縦振動モードの各圧電振動子9の先端に当接して圧力発生室4の容積を膨張、縮小させる弾性板10とを一体に積層して構成されている。

【0008】圧電振動ユニット8は、外部からの駆動信号を伝達するフレキシブルケーブル11に接続された上でヘッドホルダ12の収容室13に収容、固定され、また流路ユニット1は、ホルダー12の開口面14に固定されて記録ヘッドが構成されている。

【0009】振動子ユニット8は、圧電定数d31を有する圧電振動子9を圧力発生室4の配列ピッチに一致させて固定基板15に固定するとともに、必要に応じて圧電振動子9の列設方向の両端に位置して若干幅広に構成されたダミーの圧電振動子を固定基板15に固定して構成されている。

【0010】駆動用圧電振動子9は、図2に示したように内部共通電極17と、内部個別電極18とを圧電材料19を介してサンドイッチ状に積層し、固定端側に穿設されたスルーホール20を埋める導電層を介して内部共通電極17が並列に、また自由端側に穿設されたスルーホール21を埋める導電層を介して内部個別電極18が並列に接続されている。表面側には内部個別電極を兼ねたセグメント電極22と、コモン電極23が形成され、これら電極22、23にフレキシブルケーブル11が接続されている。

【0011】この実施例においては、各層のスルーホール20a、20b、及び21a、21bは軸方向に若干ずらせて、1層おきに同一線上に位置するように形成されている。

【0012】図3は、上述の圧電振動子ユニットの製造

方法の一実施例を示すものであって、両端近傍にスルーホール30a、31aが、圧電振動子の配列ピッチに一致するように穿設された所定厚の圧電材料のグリーンシート32を用意し(図3(I))、これの表面にスルーホール31aよりも中央部よりで、かつ内部共通電極17の先端に一致する領域に帯状の非導電領域33を形成し、かつスルーホール30a、31aの内面を埋めるように導電層34、35を導電塗料の印刷等により形成する(図3(II))。

【0013】スルーホール30a、31aとは圧電振動子の軸方向に若干、異なる位置にスルーホール30b、31bが形成された所定厚の圧電材料のグリーンシート32'を重ね(図3(III))、これの表面にスルーホール30bよりも中央部よりで、かつ内部個別電極18の先端に一致する領域に帯状の非導電領域36を形成し、かつスルーホール30b、31bの内面を埋めるように導電層37、38を形成する(図4(I))。

【0014】これらスルーホール30a、30b、31a、31bは、少なくとも1つの方向の幅を、グリーンシート32、32'の厚みより大きくなるように形成しておくと、導電層を形成する導電塗料を確実にスルーホール30a、30b、31a、31bに充填することができる。

【0015】以下、上述の工程を交互に繰り返して必要な層数だけ積層して、前述と同様のスルーホール30a、31a(30b、31b)が穿設された圧電材料のグリーンシート32"を積層し、セグメント電極22と、コモン電極23との境界に帯状の非導電領域39を形成し、かつスルーホール30a、31a(30b、31b)の内面を埋めるように導電層40、41を形成する(図4(II))。

【0016】圧電材料のグリーンシートを乾燥させてから焼成して1枚の圧電材料板42を構成し、自由端となる先端側のスルーホール31a(31b)の配列ピッチに一致するピッチで、ワイヤーソウやダイシングソウ等の切断具43により少なくとも導電層40を相互に分離できる領域まで、その底部44aが表面側が後端側に、また裏面側が先端側に位置する斜面となるように斜めの切断線Cによりスリット44を形成して、後端部側が連続部となるように歯割する(図4(III))。

【0017】なお、上述の実施例においては、圧電材料板42そのものにスリットを形成しているが、図5に示したように、非振動領域を接着剤等で固定基板45に固定してからスリット44を形成すると、作業能率の向上を図ることができる。

【0018】このように構成されたインクジェット式記録ヘッドにおいて、フレキシブルケーブル11により駆動信号を供給すると、セグメント電極22、各層のスルーホール21a、21bを介して内部個別電極18に、またコモン電極23、各層のスルーホール20a、20

bを介して内部共通電極17に駆動信号が印加され、圧電材料19の層が軸方向に収縮する。

【0019】これにより圧力発生室4が容積が膨張してインク供給口5を介してリザーバ6のインクが圧力発生室4に流れ込む。所定時間の経過後の駆動信号の供給を停止すると、圧電振動子9が元の状態に復帰して圧力発生室4の容積が相対的に収縮し、ノズル開口2からインク滴が吐出する。

【0020】ところで、圧電振動子9の先端面9a、及び後端面9bには接続用の外部電極が存在しないから、図6に示したようスルーホール20、21に至らない微小な欠け9c、9dが存在してもセグメント電極、またはコモン電極23と内部共通電極18、また内部個別電極17との導電関係を維持することができる。これにより、1枚の圧電材料板42にスリットを形成して個々の圧電振動子9に分割したり、また記録ヘッドへの組立時に、例え欠けが生じても実質的な不都合がなく、製造の歩留まりを向上することができる。

【0021】なお、上述の実施例においては、内部個別電極17、内部共通電極18、セグメント電極22、及びコモン電極23をそれぞれ両端部から露出するように形成しているが、図7に示したようにスルーホール20、21と先端面9a、または後端面9bとの間に位置するように形成すると、圧電振動子9の端面9a、9bに導電材料を当接させても内部個別電極17と内部共通電極18との短絡を防止することができる。

【0022】また、上述の実施例においては内部個別電極17、及び内部共通電極18をそれぞれスルーホール20、21により接続するようにしているが、図8(イ)、(ロ)に示したように一方、例えば先端面、または後端面のいずれか一方に外部電極24、25を形成し、内部個別電極17、または内部共通電極18を外部電極24、25により並列に接続してコモン電極23、またはセグメント電極22に接続するようにしても、製造の歩留まりを向上することができる。

【0023】さらに、上述の実施例においては、各層のスルーホール20a、20b、及び21a、21bが軸方向に若干ずらせて形成されているが、図9(イ)に示したように同一軸線A、B上に形成したり、また図9(ロ)に示したように固定領域側のスルーホールを細長い穴26として形成しても同様の作用を奏する。

【0024】

【発明の効果】以上説明したように本発明においては、振動領域に内部個別電極と内部共通電極とがラップするように導電層を圧電材料を介して積層するとともに、少なくとも一方の端部領域で圧電材料を貫通し、かつ内部個別電極となる導電層同士、または内部共通電極となる導電層同士をスルーホールに充填された導電材料により接続して、各導電層を接続するスルーホールの導電材料、または前記内部個別電極同士を接続するスルーホー

ルの導電材料に接続する外部電極層を長手方向の1つの面に形成した圧電振動子を複数固定基板に固定したので、圧電振動子を構成する内部個別電極、または内部共通電極を、圧電振動子の端面よりも内側のスルーホールにより相互接続して長手方向の表面に引き出すことができ、形成が困難な端面や、また角部へ導電層を不要として信頼性を高めることができる。また、比較的欠けが生じやすい圧電振動子の端面に外部電極が存在しないから、歯割時や記録ヘッドへの組立時に、例え欠けが生じても実質的な不都合がなく、製造の歩留まりを向上することができる。

【図面の簡単な説明】

【図1】本発明のインクジェット式記録ヘッドの一実施例を、圧電振動子の領域での断面構造でもって示す図である。

【図2】同上記録ヘッドの圧電振動子を拡大して示す断面図である。

【図3】図(I)乃至(III)は、それぞれ同上圧電振動子の製造方法の前半の工程を示す図である。

【図4】図(I)乃至(III)は、それぞれ同上圧電振動子の製造方法の後半の工程を示す図である。

【図5】圧電振動子の製造方法の他の実施例を示す図である。

【図6】同上圧電振動子の先端面に欠けが生じた状態を示す図である。

【図7】本発明の他の実施例を示す断面図である。

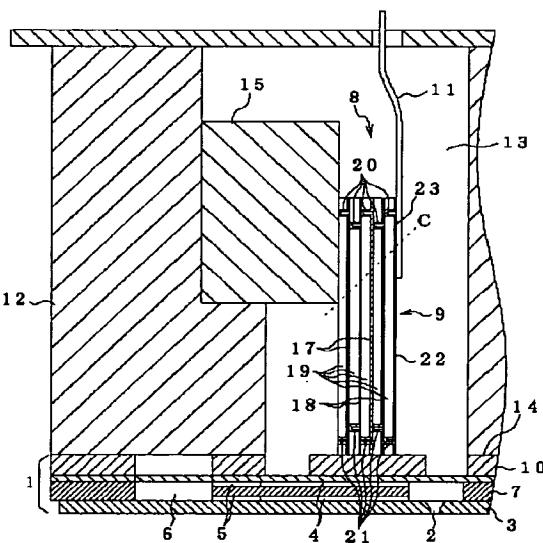
【図8】図(イ)、(ロ)は、それぞれ本発明の他の実施例を示す断面図である。

【図9】図(イ)、(ロ)は、それぞれ本発明の他の実施例を示す断面図と斜視図である。

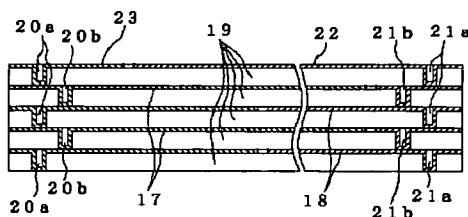
【符号の説明】

- | | |
|----|------------|
| 1 | 流路ユニット |
| 2 | ノズル開口 |
| 4 | 圧力発生室 |
| 5 | インク供給口 |
| 6 | リザーバ |
| 8 | 圧電振動ユニット |
| 9 | 圧電振動子 |
| 11 | フレキシブルケーブル |
| 12 | 内部共通電極 |
| 13 | 内部個別電極 |
| 14 | 圧電材料 |
| 20 | 接続用のスルーホール |
| 21 | セグメント電極 |
| 22 | コモン電極 |

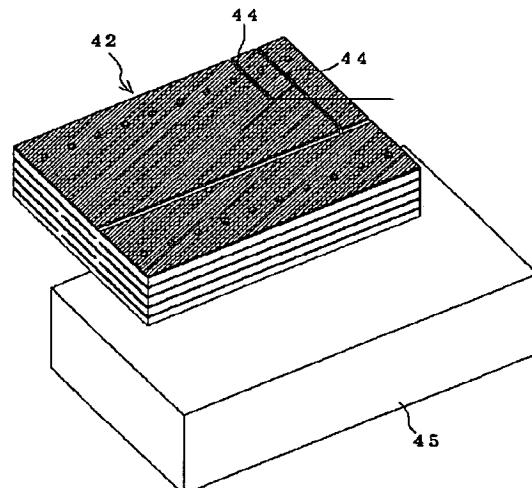
【図1】



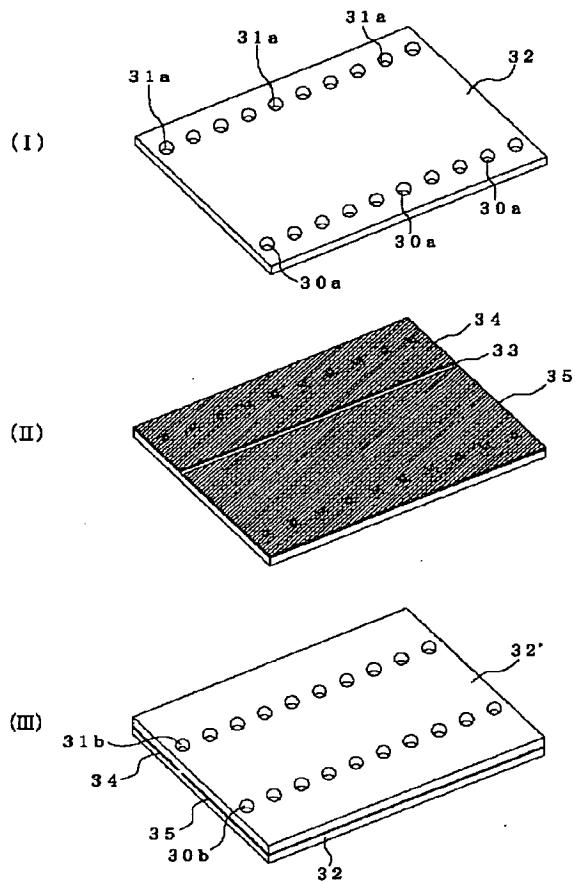
【図2】



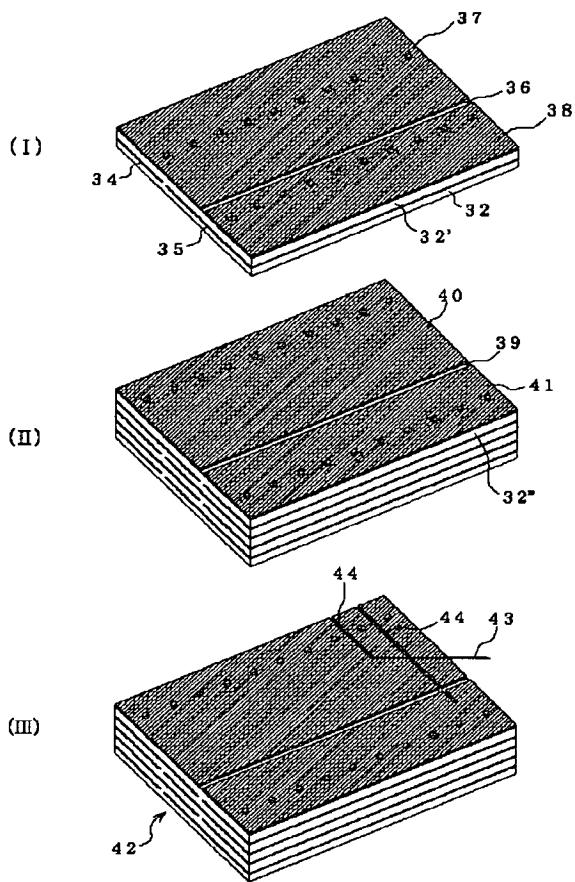
【図5】



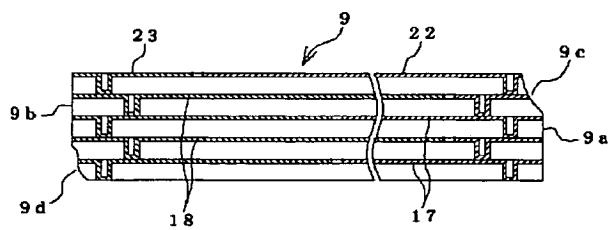
【図3】



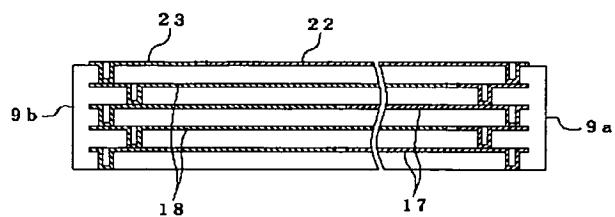
【図4】



【図6】

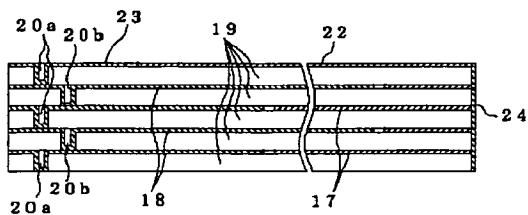


【図7】

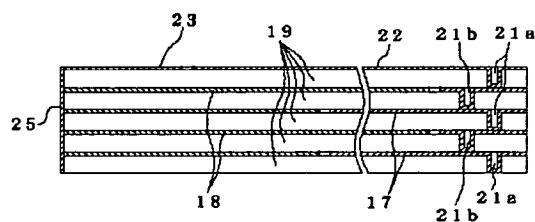


【図8】

(イ)

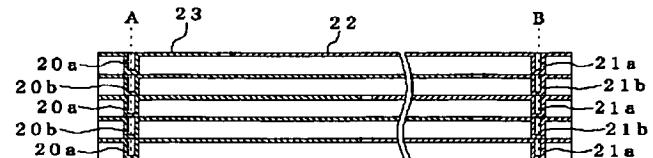


(ロ)

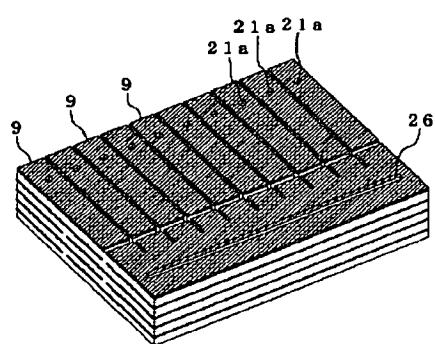


【図9】

(イ)



(ロ)



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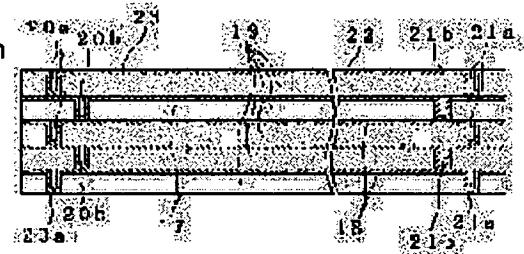
(72)Inventor : KITAHARA TSUTOMU

(54) PIEZOELECTRIC OSCILLATION UNIT, MANUFACTURE THEREOF, AND INK JET RECORDING HEAD

(57)Abstract:

PROBLEM TO BE SOLVED: To simplify the process for forming a conductive layer for external connection while enhancing reliability.

SOLUTION: Since inner individual electrodes 17 constituting a piezoelectric oscillator or conductor layers constituting an inner common electrode 18 are interconnected through through holes 21a, 21b, 20a, 20b on the inside of the end face of the piezoelectric oscillator and connected with a segment electrode 22 and a common electrode 23 formed on the surface in the longitudinal direction, end face of intricate shape or formation of conductive layer at the corner is not required and conductive relationship is ensured even if the forward end face is chipped slightly.



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CLAIMS

[Claim(s)]

[Claim 1] While carrying out the laminating of the conductive layer through piezoelectric material so that an internal individual electrode and an internal common electrode may carry out a lap to an oscillating field It connects with an electrical conducting material filled up with said conductive layers which penetrate said piezoelectric material in one [at least] edge field, and serve as said internal individual electrode, or said conductive layers used as said internal common electrode by through hole. A piezoelectric transducer unit which comes to fix to a multiple-anchorage substrate a piezoelectric transducer in which an external electrode layer linked to an electrical conducting material of said through hole which connects said each conductive layer, or an electrical conducting material of said through hole which connects said internal individual electrodes was formed to one field of a longitudinal direction.

[Claim 2] A piezoelectric transducer unit according to claim 1 which forms a through hole where said piezoelectric transducer connects said conductive layers used as said internal individual electrode for every piezoelectric transducer.

[Claim 3] A piezoelectric transducer unit according to claim 1 which forms flow relation with an electrical conducting material with which said conductive layer fills said through hole formed in an edge.

[Claim 4] A piezoelectric transducer unit according to claim 1 with which a through hole of said each class is formed on the same line.

[Claim 5] A piezoelectric transducer unit according to claim 1 with which a through hole of said each class is formed so that it may be located on the same line every other layer.

[Claim 6] A piezoelectric transducer unit according to claim 1 with which an end face of each of said conductive layer is located in a central site rather than an end face of said piezoelectric transducer.

[Claim 7] A piezoelectric transducer unit according to claim 1 with which width of face of the one direction is larger than thickness of piezoelectric material of each class, and said through hole is formed.

[Claim 8] A piezoelectric transducer unit according to claim 1 currently formed by ****(ing) by slit so that a non-vibrating field may connect mutually.

[Claim 9] A piezoelectric transducer unit according to claim 1 with which said external electrode layer consists of a material equivalent to a material which forms an internal electrode.

[Claim 10] A piezoelectric transducer unit according to claim 1 which comes to fix one field of a longitudinal direction of two or more of said vibrator to a fixed substrate.

[Claim 11] A piezoelectric transducer unit according to claim 1 which is the longitudinal-oscillation child whom said piezoelectric transducer expands and contracts in the direction where the direction of a laminating of piezoelectric material is vertical.

[Claim 12] A piezoelectric transducer unit according to claim 1 with which a segment electrode and a common electrode are formed as said external electrode.

[Claim 13] A piezoelectric transducer unit according to claim 1 with which an external electrode linked to an external electrode formed in one field of said longitudinal direction is formed in an edge field of the other end in which said through hole is not formed.

[Claim 14] A manufacture method of a piezoelectric transducer unit characterized by providing the following A process which forms an electrical conducting material layer so that a band-like field non-conducting current may be formed in a field which is center-section approach and is in agreement with a green sheet of piezoelectric material with which a through hole was drilled at a head of an internal common electrode from said through hole near [which serves as an oscillating field at least] the near edge and said through hole may be filled A process which carries out the laminating only of the required number of layers, forms a layer of an electrical conducting material so that said segment electrode and a through hole through which it flows may be filled, and constitutes one piezoelectric-material board by baking A process which forms a slit to a field which can separate a conductive layer mutually at least

[Claim 15] A manufacture method of a piezoelectric transducer unit characterized by providing the following A process which forms an electrical conducting material layer so that a band-like field non-conducting current may be formed in a field which is center-section approach and is in agreement with a green sheet of piezoelectric material with which a through hole was drilled at a head of an internal common electrode from said through hole near [which serves as an oscillating field at least] the near edge and said through hole may be filled A process which forms an electrical conducting material layer so that a band-like field non-conducting current may be formed in a field which is in agreement at a head of a piezo-electric material electrode in which a through hole was drilled near [which serves as an oscillating field at least] the near edge and said through hole may be filled A process which carries out the laminating only of the required number of layers, forms a layer of an electrical conducting material so that said segment electrode and a through hole through which it flows may be filled, and constitutes one piezoelectric-material board by baking A process which forms a slit to a field which can separate a conductive layer mutually at least

[Claim 16] A manufacture method of claim 14 drilled so that said through hole might be in agreement with an array pitch of said piezoelectric transducer, or a piezoelectric transducer unit according to claim 15.

[Claim 17] A manufacture method of claim 14 which consists of a process which forms a slit to a field which is the pitch which is in agreement with an array pitch of a through hole by the side of a head used as the free end, and can separate a conductive layer mutually at least, or a piezoelectric transducer unit according to claim 15.

[Claim 18] While carrying out the laminating of the conductive layer through piezoelectric material so that an internal individual electrode and an internal common electrode may carry out a lap to an oscillating field While connecting with an electrical conducting material filled up with said conductive layers which penetrate said piezoelectric material in one [at least] edge field, and serve as said internal individual electrode, or said conductive layers used as an internal common electrode by through hole A piezoelectric transducer unit which comes to fix to a multiple-anchorage substrate a piezoelectric transducer in which an external electrode layer linked to an electrical conducting material of a through hole which connects said each conductive layer, or an electrical conducting material of a through hole which connects said internal individual electrodes was formed to one field of a longitudinal direction, An ink jet type recording head which comes to fix a passage unit equipped with a pressure generating room which is open for free passage to a nozzle orifice and a reservoir, and is pressurized with said piezoelectric transducer with a head holder.

[Translation done.]

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DETAILED DESCRIPTION**[Detailed Description of the Invention]**

[0001]

[The technical field to which invention belongs] This invention relates to flexible shaft orientations at the structure and the ink jet type recording head of an internal electrode at the piezoelectric transducer unit with which laminating formation of the internal electrode was carried out at parallel, and twist details.

[0002]

[Description of the Prior Art] The ink jet type recording head which used the piezoelectric transducer in longitudinal-oscillation mode Set a narrow gap at the back of the nozzle plate which drilled two or more nozzles, and an elastic plate is arranged in it so that JP,4-1052,A may see. Make the piezoelectric transducer of a piezoelectric constant d31 divided so that it might furthermore correspond to the back of an elastic plate at each pressure generating room of a passage formation substrate contact, constitute, and after making it go via an ink feed hopper and leading to a pressure generating room, the ink from RISABA It pressurizes with the piezoelectric transducer which made the ink here drive according to a record signal, and is made to make it breathe out from a nozzle orifice as an ink drop.

[0003] Such a piezoelectric transducer so that JP,7-195688,A may see An internal common electrode, The laminating of the internal individual electrode is carried out to the shape of sandwiches through piezoelectric material. An internal common electrode to the back end side by the side of the fixed end Moreover, the piezo-electric diaphragm of one sheet which exposed the internal individual electrode to the apical surface of free one end is ****(ed) and constituted so that a non-vibrating field may follow ends in a dummy piezoelectric transducer and may follow a center section in the piezoelectric transducer for actuation again. An internal common electrode is connected to the common electrode prolonged from a back end side to a non-vibrating field, a FUREKISHIBU cable is connected to these segment electrode and a common electrode, and the driving signal is supplied to the segment electrode with which an internal individual electrode is prolonged from an apical surface to a non-vibrating field.

[0004]

[Problem(s) to be Solved by the Invention] Thus, it is easy to produce a defect in the conductive layer in the boundary of an end face and a front face on the relation which forms an external electrode in the 2nd page of an end face and a front face at a ** type, and there are a problem that conductive layer formation takes time and effort, and a problem that a corner produces comparatively a chip and the faulty connection who becomes empty again, and the yield of manufacture falls. The place which this invention is made in view of such a problem, and is made into the object is offering the piezoelectric transducer unit which can secure flow relation also by the chip of the some at a head. Moreover, the 2nd object of this invention is proposing the manufacture method of said piezoelectric transducer unit. Furthermore, the 3rd object of this invention is offering the ink jet type recording head which used said piezoelectric transducer unit.

[0005]

[Means for Solving the Problem] In order to solve such a problem, it sets to this invention. While carrying out the laminating of the conductive layer through piezoelectric material so that an internal individual electrode and an internal common electrode may carry out a lap to an oscillating field It connects with an electrical conducting material filled up with said conductive layers which penetrate said piezoelectric material in one [at least] edge field, and serve as said internal individual electrode, or said conductive layers used as said internal common electrode by through hole. A piezoelectric transducer in which an external electrode layer linked to an electrical conducting material of said through hole which connects said each conductive layer, or an electrical conducting material of said through hole which connects said internal individual electrodes was formed to one field of a longitudinal direction was fixed to a multiple-anchorage substrate.

[0006]

[Function] since it interconnects in the through hole inside the end face of a piezoelectric transducer and the conductive layers which constitute the internal individual electrode which constitutes a piezoelectric transducer, or an internal common electrode are pulled out on the surface of a longitudinal direction -- an end face with difficult formation -- moreover, the conductive layer to a corner becomes unnecessary.

[0007]

[Embodiment of the Invention] Then, based on the example illustrating the details of this invention, it explains below. Drawing 1 is what shows one example of the ink jet type recording head of this invention. The passage unit 1 The passage formation substrate 7 equipped with the nozzle plate 3 which drilled the nozzle orifice 2 at constant pitch, and the pressure generating room 4 which is open for free passage to a nozzle orifice 2 and the reservoir 6 which supplies ink to this through the ink feed hopper 5, The laminating of the elastic plate 10 to which contact at the head of each piezoelectric transducer 9 in the longitudinal-oscillation mode of the piezo-electric oscillating unit 8, and expand and the capacity of the pressure generating room 4 is made to reduce is carried out to one, and it is constituted.

[0008] The piezo-electric oscillating unit 8 is held and fixed to the hold room 13 of the head holder 12 after connecting with the flexible cable 11 which transmits the driving signal from the outside, and the passage unit 1 is fixed to the effective area 14 of an electrode holder 12, and the recording head is constituted.

[0009] The vibrator unit 8 fixes to the fixed substrate 15 the piezoelectric transducer of the dummy which was located in the ends of the successive installation direction of a piezoelectric transducer 9 if needed, and was constituted broadly a little, and is constituted while making in agreement with the array pitch of the pressure generating room 4 the piezoelectric transducer 9 which has a piezoelectric constant d31 and fixing to the fixed substrate 15.

[0010] The piezoelectric transducer 9 for actuation carries out the laminating of the internal common electrode 17 and the internal individual electrode 18 to the shape of sandwiches through piezoelectric material 19, as shown in drawing 2, and the internal individual electrode 18 is connected to juxtaposition through the conductive layer which fills the through hole 21 in which the internal common electrode 17 was drilled by free one end in parallel through the conductive layer which fills the through hole 20 drilled in the fixed-end side. The segment electrode 22 which served as the internal individual electrode, and the common electrode 23 are formed in a front-face side, and the flexible cable 11 is connected to these electrodes 22 and 23.

[0011] In this example, the through holes 20a and 20b of each class, and 21a and 21b can be shifted a little to shaft orientations, and they are formed so that it may be located on the same line every other layer.

[0012] Drawing 3 is what shows one example of the manufacture method of an above-mentioned piezoelectric transducer unit. Through holes 30a and 31a prepare near the ends the green sheet 32 of the piezoelectric material of the given thickness drilled so that it might be in agreement with the array pitch of a piezoelectric transducer (drawing 3 (I)). On the surface of [a / through hole 31] this by the center-section twist And conductive layers 34 and 35 are formed by printing of conductive coating material etc. so that the band-like field 33 non-conducting current may be formed in the field which is in agreement at the head of the internal common electrode 17 and the inner surface of through holes 30a and 31a may be buried (drawing 3 (II)).

[0013] In through holes 30a and 31a, a little in a location which is different in the shaft orientations of a piezoelectric transducer Through hole 30b, Green sheet 32' of the piezoelectric material of given thickness with which 31b was formed is piled up (drawing 3 (III)). On the surface of [b / through hole 30] this by the center-section twist And conductive layers 37 and 38 are formed so that the band-like field 36 non-conducting current may be formed in the field which is in agreement at the head of the internal individual electrode 18 and the inner surface of through holes 30b and 31b may be buried (drawing 4 (I)).

[0014] These through holes 30a, 30b, 31a, and 31b can fill up through holes 30a, 30b, 31a, and 31b with the conductive coating material which forms a conductive layer certainly, if the width of face of at least one direction is formed so that it may become larger than the thickness of a green sheet 32 and 32'.

[0015] the green sheet 32 of the piezoelectric material with which the above-mentioned process was repeated by turns, the laminating only of the required number of layers was hereafter carried out, and the same through holes 30a and 31a (30b, 31b) as the above-mentioned were drilled -- " -- a laminating -- carrying out -- the segment electrode 22 -- Conductive layers 40 and 41 are formed so that the band-like field 39 non-conducting current may be formed in a boundary with the common electrode 23 and the inner surface of through holes 30a and 31a (30b, 31b) may be buried (drawing 4 (II)).

[0016] In the pitch which is in agreement with the array pitch of through hole 31a by the side of the head which calcinates since the green sheet of piezoelectric material is dried, constitutes one piezoelectric-material board 42, and turns into the free end (31b) To the field which can separate a conductive layer 40 mutually at least with the cutting

implements 43, such as a wire saw and a dicing saw A slit 44 is formed with the slanting cutting plane line C so that the pars-basilaris-ossis-occipitalis 44a may become the slant face where a front-face side is located in a back end side, and a rear-face side is located in a head side, and it **** so that a back end section side may serve as the continuation section (drawing 4 (III)).

[0017] In addition, in an above-mentioned example, although the slit is formed in that of piezoelectric-material board 42 itself, if a slit 44 is formed after fixing a non-vibrating field to the fixed substrate 45 with adhesives etc. as shown in drawing 5, improvement in working capacity can be aimed at.

[0018] Thus, in the constituted ink jet type recording head, if a driving signal is supplied with the flexible cable 11, through the segment electrode 22 and the through holes 21a and 21b of each class, a driving signal will be impressed to the internal common electrode 17 again through the common electrode 23 and the through holes 20a and 20b of each class, and the layer of piezoelectric material 19 will contract to the internal individual electrode 18 at shaft orientations.

[0019] Capacity expands [the pressure generating room 4] by this, and the ink of a reservoir 6 flows into the pressure generating room 4 through the ink feed hopper 5. If supply of the driving signal after progress of predetermined time is suspended, a piezoelectric transducer 9 will return to the original condition, the capacity of the pressure generating room 4 will contract relatively, and an ink drop will carry out the regurgitation from a nozzle orifice 2.

[0020] By the way, since the external electrode for connection does not exist in apical surface 9a of a piezoelectric transducer 9, and back end side 9b, as shown in drawing 6, even if the minute chips 9c and 9d which do not reach through holes 20 and 21 exist, the electric conduction relation between a segment electrode or the common electrode 23 and the internal common electrode 18, and the internal individual electrode 17 is maintainable. Even if it forms a slit in one piezoelectric-material board 42, and it divides into each piezoelectric transducer 9 and a metaphor chip arises by this at the time of the assembly to a recording head, there is no substantial inconvenience, and the yield of manufacture can be improved.

[0021] In addition, although it forms in an above-mentioned example so that the internal individual electrode 17, the internal common electrode 18, the segment electrode 22, and the common electrode 23 may be exposed from both ends, respectively If it forms so that it may be located between through holes 20 and 21, apical surface 9a, or back end side 9b as shown in drawing 7, even if it makes an electrical conducting material contact the end faces 9a and 9b of a piezoelectric transducer 9, the short circuit of the internal individual electrode 17 and the internal common electrode 18 can be prevented.

[0022] Moreover, although he is trying to connect the internal individual electrode 17 and the internal common electrode 18 by through holes 20 and 21 in an above-mentioned example, respectively As shown in drawing 8 (b) and (b), on the other hand, the external electrodes 24 and 25 are formed in either an apical surface or a back end side. The yield of manufacture can be improved, even if it connects the internal individual electrode 17 or the internal common electrode 18 to juxtaposition with the external electrodes 24 and 25 and makes it connect with the common electrode 23 or the segment electrode 22.

[0023] Furthermore, in an above-mentioned example, although the through holes 20a and 20b of each class, and 21a and 21b can shift to shaft orientations a little and are formed in them, even if it forms on the same axes A and B, and it forms the through hole by the side of a fixed area as a slit 26 as shown in drawing 9 (b) as shown in drawing 9 (b), the same operation is done so.

[0024]

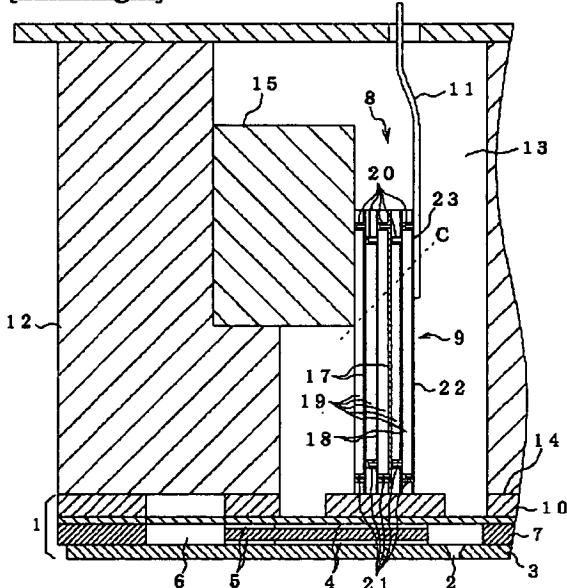
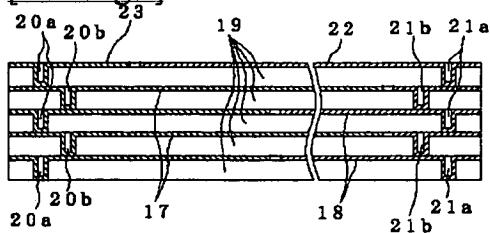
[Effect of the Invention] While carrying out the laminating of the conductive layer through piezoelectric material in this invention so that an internal individual electrode and an internal common electrode may carry out a lap to an oscillating field as explained above It connects with the electrical conducting material filled up with the conductive layers which penetrate piezoelectric material in one [at least] edge field, and serve as an internal individual electrode, or the conductive layers used as an internal common electrode by the through hole. Since the piezoelectric transducer in which the external electrode layer linked to the electrical conducting material of a through hole which connects each conductive layer, or the electrical conducting material of a through hole which connects said internal individual electrodes was formed to one field of a longitudinal direction was fixed to the multiple-anchorage substrate the internal individual electrode which constitutes a piezoelectric transducer, or an internal common electrode -- the through hole inside the end face of a piezoelectric transducer -- interconnecting -- the front face of a longitudinal direction -- it can pull out -- an end face with difficult formation -- moreover, reliability can be raised, being able to use a conductive layer as unnecessary to a corner. Moreover, since an external electrode does not exist in the end face of the piezoelectric transducer which a chip tends [comparatively] to produce, at the time of **** and the assembly to a recording head, even if a metaphor chip arises, there is no substantial inconvenience, and the yield of manufacture can be improved at it.

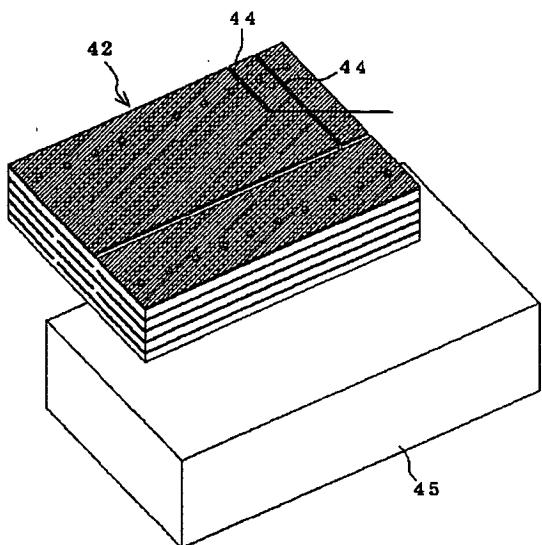
[Translation done.]

*** NOTICES ***

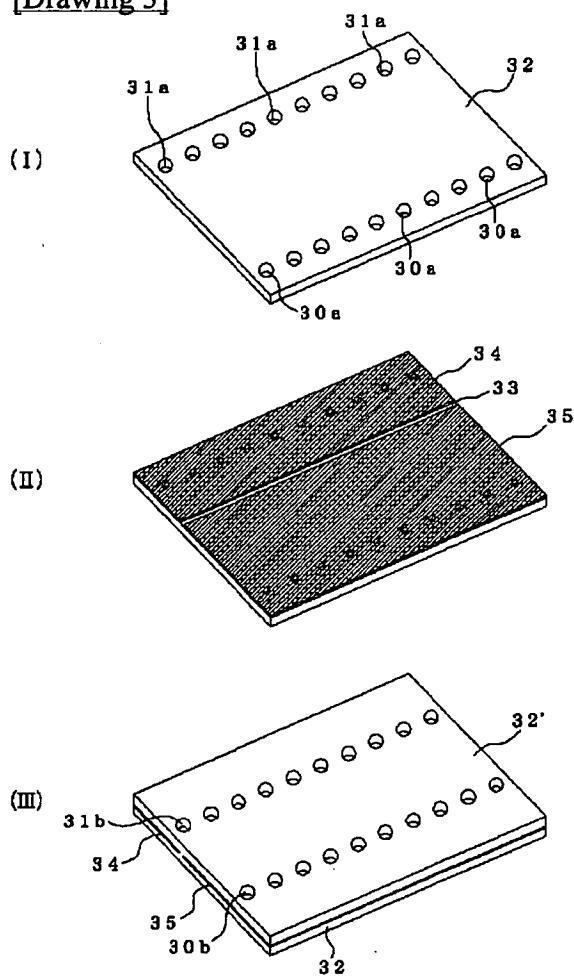
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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

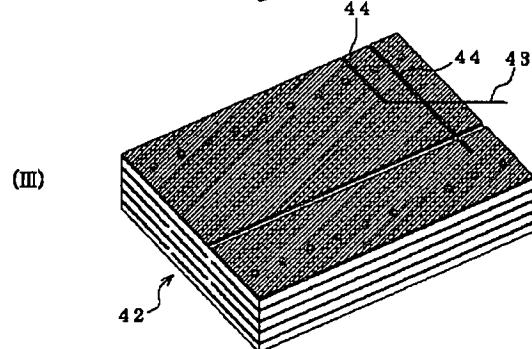
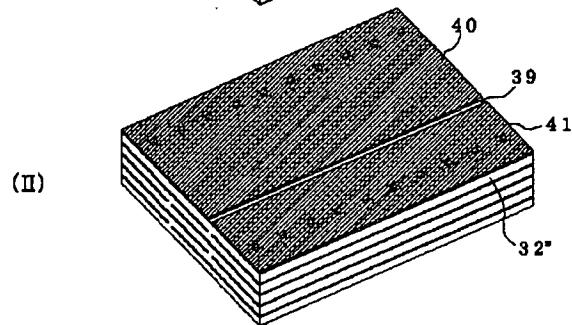
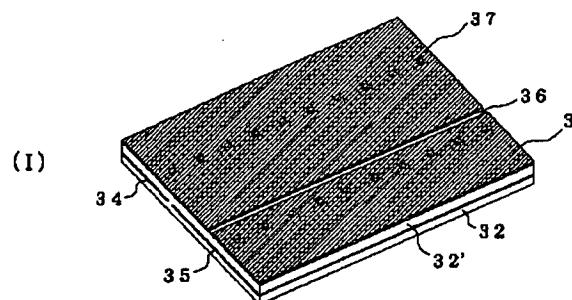
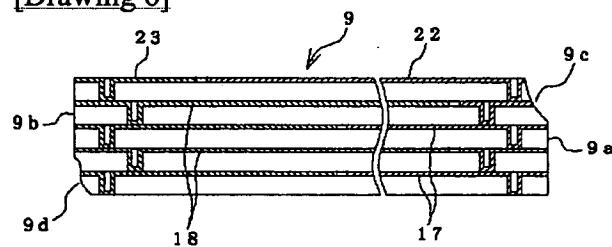
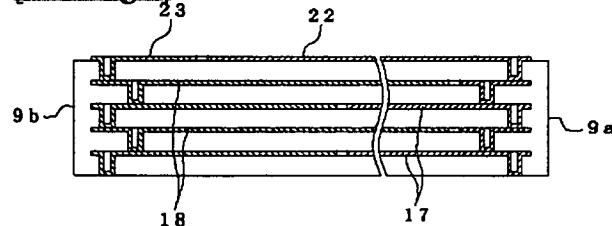
DRAWINGS**[Drawing 1]****[Drawing 2]****[Drawing 5]**



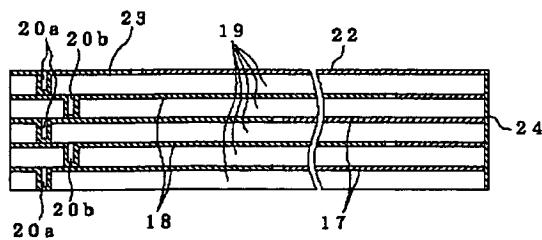
[Drawing 3]



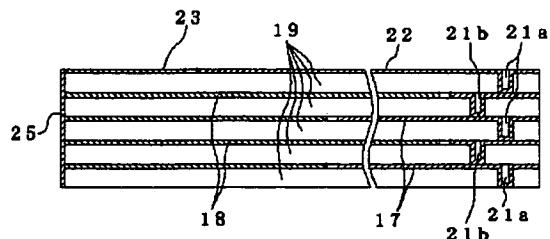
[Drawing 4]

**[Drawing 6]****[Drawing 7]****[Drawing 8]**

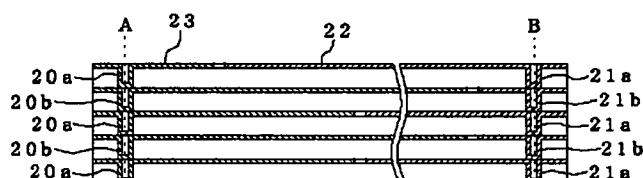
(1)



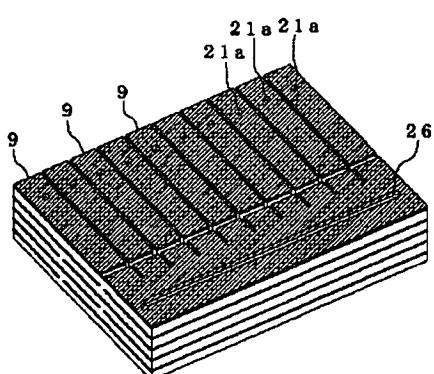
(2)

[Drawing 9]

(1)



(2)



[Translation done.]